PHOTORECEPTOR MEMBRANES AND VISUAL PIGMENTS IN THE APPOSITION EYES OF THE TERRESTRIAL CRAB, *OCYPODE RYDERI* (OCYPODIDAE), DURING THE DAILY LIGHT CYCLE

The ghost crab, *Ocypode ryderi*, is very common on the equatorial sandy beaches of the east African coast. The activity periods of these animals are ruled by the tides, and therefore they feed at the water-line of low, rising tides during both day and night. Their very large compound eyes are of the apposition type, which adapt to strongly different light intensities by changing the size of the rhabdoms in each ommatidium. These changes are controlled internally (without the need for an external zeitgeber) according to the diurnal cycle.

Morphometric studies on the form of the rhabdom and the size of its microvilli gave the following results. The rhabdom volume changes — while its length remains constant by a factor of 8. The total surface of the microvillar membranes, however, changes only by a factor of 6, because the diameter of each microvillus is slightly larger during night than day. The visual pigment molecules are closely packed in the membranes, as can be seen in electron micrographs of freeze fracture preparations, where each particle represents a group of four molecules.

The rhabdom, which consists of the rhabdomeres of eight visual cells, has a characteristic variation of its form during the daily cycle. The most distal part, which is built exclusively by the distal receptor cell, named no. 8, exhibits the greatest volume change. Its variation in diameter is paralleled by the proximal surface of the crystalline cone. The rhabdomeres of the other seven receptor cells together all arrange to form a long, thin conus. The change in its diameter is much more pronounced in the distal than in the proximal part.

The visual pigment content — as measured spectrometrically in extracts — parallels the change in microvillar surface: during the night there is 6.5 times the amount as during the day. In contrast, the protein moiety, opsin, changes significantly less — only by a factor of 4 — which means that a considerable part of it is stored in the cell during the day. It is unknown where this lipophilic material is situated.

The visual pigment, rhodopsin, consists of the protein moiety opsin and its chromophoric group, which was determined by HPLC as retinal$_1$. The characterization of the spectral properties of the pigment system in the eyes of *Ocypode* was carried out by successive irradiation of digitonin-extracts from isolated rhabdom-membranes with monochromatic lights. Short-time illumination (< 1 min) with long wavelengths (590 nm) transforms the blue sensitive visual pigment (P_{470}) into its metarhodopsin (M_{520}). Longer lasting illuminations lead to the decay of metarhodopsin into opsin and free retinal$_1$ (λmax 380 nm) or, in the presence of hydroxylamine, retinal-oxime (λmax 368 nm).

Further illuminations with light of a shorter wavelength (471 nm) lead to a decrease in absorbance around 430 nm and to an increase around 510 nm. Illuminations were carried out until no changes in the difference-spectra after illumination could be observed. Computations from the difference-spectra obtained, using nomograms from EBREY & HONIG (1977, Vision Res 17, 147), resulted in a visual pigment with a λmax of 424 nm and a metarhodopsin with a λmax of 518 nm. Light of 530 nm reconverts the metarhodopsin into rhodopsin.

Additional illumination with UV-light (348 nm) leads to a decrease of the absorbance around 350 nm and to an increase around 510 nm. The photoproduct of this conversion is thermostable at 8°C and can be reconverted into rhodopsin by illumination with 517 nm. Computations of these spectra gave a UV-visual pigment with a λmax of 355 nm and a metarhodopsin with a λmax of 510 nm.

These pigments, which are expected to occur in different receptor cells, together build a three-component-colour vision system, which is demonstrated here for the first time in a decapod crustacean.

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